Trigen Energy Corporation – Grays Ferry Cogeneration Project

Background

Trigen Energy Corporation provides heating, cooling, and electricity to more than 1,500 customer facilities nationwide, including municipalities, industrial complexes, hotels, sports arenas, convention centers, and residential complexes. Trigen - Philadelphia, the largest operating company of Trigen, constructed a new central power plant in 1996 to produce steam for the Trigen Philadelphia District Heating System. The plant, known as Grays Ferry Cogeneration Project (GFCP), was a joint venture between Trigen, PECO's Exelon Corp., and NRG Generating.

When Trigen bought the district energy system in 1993, large oil-fired boilers produced the steam. Trigen constructed the new 170 MW_e combined cycle plant on the existing Schuylkill Station Plant site. Several of the prior existing boilers serve as reserve and peaking capacity. Trigen provides 375 customers (70% of Philadelphia's downtown buildings and institutional facilities) with steam for heating, cooling, domestic hot water production, and cooking through 33 miles of underground steam pipe.

Project Description

The Grays Ferry Cogeneration Project prime mover is a dual-fueled, 118 MW_e combustion turbine. The turbine can use either natural gas or #2 oil, depending on price and availability. Exhaust gas from the combustion turbine produces high-pressure steam, which produces as much as an extra 52 MW_e using a condensing/extracting steam turbine. The plant also consists of a stand-alone 700,000 pound per hour auxiliary boiler. In total, the plant has an electric capacity of 170 MW_e and a steam output of 1.5 million pounds per hour.

The project integrates several technologies including direct-mechanical drives, direct heating, and absorption chillers among others to bring the overall plant efficiency to 74 percent. In addition, Grays Facility uses a dry low NO_x turbine in combination with selective catalytic reduction (SCR) to control NO_x emissions.

Trigen - Gray's Ferry Cogeneration Project Operating Data for 1998*	
Project Design Capacity (MW_e)	170
Power to Heat Ratio	0.6
Total Net Efficiency (HHV)	74%
% Fuel Savings[1]	13% (27,000 metric tons of carbon)
Effective Electric Efficiency[2] (HHV)	66%
% NO_x Decrease[3]	77% (1,800 tons)

**Data based on 8,760 annual hours of operation*

[1] Savings based on 49% efficient electric and 81% efficient thermal generation with natural gas as the primary fuel.
[2] Effective Electric Efficiency = (CHP power output)/(Total energy input to CHP system – total heat recovered/0.81). Assumes thermal output provided at 81% efficiency.
[3] Compared to electric emissions of 3.6 lb NO_x/MWh (1998 national average) and boiler emissions of 0.1 lb NO_x/MMBtu.

Success Strategy

Trigen formed a partnership with Adwin Cogeneration, a subsidiary of the local utility PECO Energy, as soon as it acquired the district heating system in 1993. Consequently, the Grays Ferry project had a relatively smooth start without lengthy dispute over stranded costs. Adwin supervised the development of the central steam system to handle electric power generation while NRG Generating managed construction of the project. Under the partnership agreement, Trigen-Philadelphia will oversee system operation for the length of its 25-year electric-steam contract, while PECO Energy will purchase up to 150 MW of the plant's electricity under a 20-year contract. Currently, the Grays Ferry plant sells 97 percent of electricity generated to the grid.

Benefits

The Grays Ferry project was a particularly attractive investment opportunity for Trigen-Philadelphia, because Philadelphia has one of the largest district energy systems in the United States. For Trigen's customers, the district energy system provides economic energy, saves building owners the cost of constructing and operating boilers and chillers, eliminates fuel storage requirements, and increases available leasing space.

While Grays Ferry Cogeneration Project expanded Trigen-Philadelphia's energy capacity, it had the added benefit of lowering Philadelphia's regional emissions. The annual NO_x reduction from the facility is equivalent to the annual emissions from 94,000 cars. The project also uses 13% less fuel than separate heat and power, conserving 1.6 billion standard cubic feet of natural gas and 61,000 barrels of oil a year, and has climate benefits as it annually releases 110,000 fewer tons of CO_2. This is the equivalent of planting 30,000 acres of forest or displacing the annual greenhouse gas emissions from 10,000 households.

In March 2000, the United States Environmental Protection Agency and the Department of Energy recognized the pollution prevention benefits of this CHP facility with an ENERGY STAR® CHP Award. For more information on ENERGY STAR® CHP awards, please click here.